

See "Instructions for Filling out the Work Permit" contained in the Work Planning and Control for Experiments and Operations Subject Area.

**1. Work request WCC fills out this section.**

☐ Standing Work Permit

Requester: Don Lynch	Date: 7/1/2016	Ext.: 2253	Dept/Div/Group: PO/ PHENIX
Other Contact person (if different from requester): Carter Biggs			Ext.: 7515
Work Control Coordinator: Don Lynch		Start Date: 07/11/2016	Est. End Date: 8/1/2016
Brief Description of Work: Removal of VTX & FVTX subsystems from PHENIX IR to Physics for future repurposing			
Building: 1008, 555, 510	Room: IR	Equipment: VTX & FVTX	Service Provider PHENIX Techs, VTX & FVTX experts

**2. WCC, Requester/Designee, Service Provider, and ESS&H (as necessary) fill out this section or attach analysis**

<b>ESS&amp;H ANALYSIS</b>			
<b>Radiation Concerns</b>	<input type="checkbox"/> None	<input checked="" type="checkbox"/> Activation	<input type="checkbox"/> Airborne
	<input type="checkbox"/> Contamination	<input type="checkbox"/> Radiation	<input type="checkbox"/> NORM
	<input type="checkbox"/> Other		
<input type="checkbox"/> Special nuclear materials involved, notify Isotope Special Materials Group			
<input type="checkbox"/> Fissionable/Radiological materials involved, notify Laboratory Nuclear Safety Officer			
<b>Radiation Generating Devices:</b>	<input type="checkbox"/> Radiography	<input type="checkbox"/> Moisture Density Gauges	<input type="checkbox"/> Soil Density Gauges
	<input type="checkbox"/> X-ray Equipment		
<b>Safety and Security Concerns</b>	<input type="checkbox"/> None	<input type="checkbox"/> Explosives	<input type="checkbox"/> Transport of Haz/Rad Material
	<input checked="" type="checkbox"/> Pressurized Systems		
<input type="checkbox"/> Adding/Removing Walls or Roofs	<input type="checkbox"/> Critical Lift	<input type="checkbox"/> Fumes/Mist/Dust*	<input type="checkbox"/> Magnetic Fields*
<input type="checkbox"/> Asbestos*	<input type="checkbox"/> Cryogenic	<input type="checkbox"/> Heat/Cold Stress	<input type="checkbox"/> Nanomaterials/particles*
<input type="checkbox"/> Beryllium*	<input type="checkbox"/> Electrical	<input type="checkbox"/> Hydraulic	<input type="checkbox"/> Noise*
<input type="checkbox"/> Biohazard*	<input checked="" type="checkbox"/> Elevated Work	<input type="checkbox"/> Lasers*	<input type="checkbox"/> Non-ionizing Radiation*
<input type="checkbox"/> Chemicals/Corrosives*	<input type="checkbox"/> Excavation	<input type="checkbox"/> Lead*	<input type="checkbox"/> Oxygen Deficiency*
<input type="checkbox"/> Confined Space*	<input type="checkbox"/> Ergonomics*	<input type="checkbox"/> Material Handling	<input type="checkbox"/> Penetrating Fire Walls
<input type="checkbox"/> Vacuum			
* Safety Health Rep. Review Required	<input type="checkbox"/> Haz, Rad, Bio Material Exceed DOE 151.1-C Levels - Contact OEM	<input type="checkbox"/> Other	
<b>Environmental Concerns</b>			
<input type="checkbox"/> Atmospheric Discharges (rad/non-rad)	<input checked="" type="checkbox"/> None	<input type="checkbox"/> Work impacts Environmental Permit No.	
<input type="checkbox"/> Chemical or Rad Material Storage or Use	<input type="checkbox"/> Land Use Institutional Controls	<input type="checkbox"/> Soil Activation/contamination	<input type="checkbox"/> Waste-Mixed
<input type="checkbox"/> Cesspools (UIC)	<input type="checkbox"/> Liquid Discharges	<input type="checkbox"/> Waste-Clean	<input type="checkbox"/> Waste-Radioactive
<input type="checkbox"/> High water/power consumption	<input type="checkbox"/> Oil/PCB Management	<input type="checkbox"/> Waste-Hazardous	<input type="checkbox"/> Waste-Regulated Medical
<input type="checkbox"/> Spill potential	<input type="checkbox"/> Waste-Industrial	<input type="checkbox"/> Underground Duct/Piping	
Waste disposition by:	<input type="checkbox"/> Other		
<b>Pollution Prevention (P2)/Waste Minimization Opportunity:</b>	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes	
<b>FACILITY CONCERNS</b>			
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Intermittent Energy Release		
<input type="checkbox"/> Access/Egress Limitations	<input type="checkbox"/> Electrical Noise	<input type="checkbox"/> Potential to Cause a False Alarm	<input type="checkbox"/> Vibrations
<input type="checkbox"/> Impacts Facility Use Agreement	<input type="checkbox"/> Temperature Change	<input type="checkbox"/> Other	
<input type="checkbox"/> Configuration Management	<input type="checkbox"/> Maintenance Work on Ventilation Systems	<input type="checkbox"/> Utility Interruptions	
<b>WORK CONTROLS</b>			
<b>Work Practices</b>			
<input type="checkbox"/> None	<input type="checkbox"/> Exhaust Ventilation	<input checked="" type="checkbox"/> Lockout/Tagout	<input type="checkbox"/> Spill Containment
<input checked="" type="checkbox"/> Back-up Person/Watch	<input type="checkbox"/> HP Coverage	<input type="checkbox"/> Posting/Warning Signs	<input type="checkbox"/> Time Limitation
<input type="checkbox"/> Other			
<input type="checkbox"/> Barricades	<input type="checkbox"/> IH Survey	<input type="checkbox"/> Scaffolding-requires inspection	<input type="checkbox"/> Warning Alarm (i.e. "high level")
<input type="checkbox"/> Electrical Inspection Required			
<b>Personal Protective Equipment</b>			
<input type="checkbox"/> None	<input type="checkbox"/> Ear Plugs	<input checked="" type="checkbox"/> Gloves, as necessary	<input type="checkbox"/> Lab Coat
<input type="checkbox"/> Coveralls	<input type="checkbox"/> Ear Muffs	<input type="checkbox"/> Goggles	<input type="checkbox"/> Respirator*
<input type="checkbox"/> Safety Glasses	<input type="checkbox"/> Safety Harness		
<input type="checkbox"/> Disposable Clothing	<input type="checkbox"/> Face Shield	<input type="checkbox"/> Hard Hat	<input type="checkbox"/> Shoe Covers
<input checked="" type="checkbox"/> Safety Shoes	<input type="checkbox"/> High visibility cloths/vest	<input type="checkbox"/> Other	
<b>Permits Required (Permits must be valid when job is scheduled.)</b>			
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Cutting/Welding	<input type="checkbox"/> Impair Fire Protection Systems	
<input type="checkbox"/> Concrete/Masonry Penetration	<input type="checkbox"/> Digging/Core Drilling	<input type="checkbox"/> Rad Work Permit-RWP No	
<input type="checkbox"/> Confined Space Entry	<input type="checkbox"/> Electrical Working Hot	<input type="checkbox"/> Other	
<b>Dosimetry/Monitoring</b>			
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Heat Stress Monitor	<input type="checkbox"/> Real Time Monitor	<input type="checkbox"/> TLD
<input type="checkbox"/> Air Effluent	<input type="checkbox"/> Noise Survey/Dosimeter	<input type="checkbox"/> Self-reading Pencil Dosimeter	<input type="checkbox"/> Waste Characterization
<input type="checkbox"/> Ground Water	<input type="checkbox"/> O <sub>2</sub> /Combustible Gas	<input type="checkbox"/> Self-reading Digital Dosimeter	<input type="checkbox"/> Other
<input type="checkbox"/> Liquid Effluent	<input type="checkbox"/> Passive Vapor Monitor	<input type="checkbox"/> Sorbent Tube/Filter Pump	
<b>Training Requirements (List specific training requirements)</b>			
CA -Collider User, PHENIX Awareness, Working at heights			
<b>Based on analysis above, the Review Team determines the risk, complexity, and coordination ratings below:</b>		<b>If using the permit when all hazard ratings are low, only the following need to sign: ( Although allowed, there is no need to use back of form)</b>	
<b>ESS&amp;H Risk Level:</b>	<input checked="" type="checkbox"/> Low	<input type="checkbox"/> Moderate	<input type="checkbox"/> High
<b>Complexity Level:</b>	<input type="checkbox"/> Low	<input checked="" type="checkbox"/> Moderate	<input type="checkbox"/> High
<b>Work Coordination:</b>	<input type="checkbox"/> Low	<input checked="" type="checkbox"/> Moderate	<input type="checkbox"/> High
WCC:		Date:	
Service Provider:		Date:	
Authorization to start		Date:	
(Department/Division, or their equivalent, Sup/WCC/Designee)			

### 3. Both work requester and service provider contribute to work plan (use attachments for detailed plans)

**Work Plan** (procedures, timing, equipment, scheduling, coordination, notifications, and personnel availability need to be addressed in adequate detail):

During the 2014 Shutdown, PHENIX will be (1) un-installing the VTX & FVTX detector subsystems, (2) transporting the VTX & FVTX detector ½'s to a BNL Physics lab for disassembly & separation of the VTX and FVTX, (3) maintenance, repair and upgrade of the VTX and FVTX sections, 4) the FVTX sections will then be re-assembled, reintegrated and re-surveyed with the VTX.(5) the re-assembled VTX and FVTX ½'s will then be transported to the PHENIX IR where they will be re-installed, re-surveyed and re-commissioned for service during run 15. The procedure for accomplishing these tasks is attached.

Special Working Conditions Required (e.g., Industrial Hygiene hold points or other monitoring)  
None

Notifications to operations and Operational Limits Requirements: No

Post Work Testing, Notification or Documentation Required: Commissioning and re-certification tests for operational integrity.

Job Safety Analysis Required: ☐ Yes ☒ No

Review Done: ☒ in series ☐ team

**Reviewed by:** \* Primary Reviewer signature means that the Review Team members were appropriate for the work that was planned, the Team visited the job site, hazards and risks that could impact ESS&H have been considered and controls established according to BNL requirements. In addition, this signature indicates that applicable JRAs, FRAs, as well as other planning documents have been reviewed and training requirements have been identified and recorded on this permit.

Title	Name (print)	Signature	Life #	Date
ES&H Professional				
F&O Facility Project Manager				
Service Provider				
Work Control Coordinator	Don Lynch		20146	
Safety Health Representative				
Research Space Manager				
Other				
Other (PHENIX Escort)				
Required Walkdown Completed				
*Primary Reviewer				

### 4. Job site personnel (Supervisor and workers) fill out this section.

Note: Signature indicates personnel performing work have read and understand the hazards and permit requirements (including any attachments) and all training required for this permit is current/complete. Job Supervisor/Contractor Supervisor signatures also includes verification that worker training required for this permit is current/complete.

Job Supervisor:		Contractor Supervisor:	
Workers:	Life#:	Workers :	Life#:

Workers are encouraged to provide feedback on ESS&H concerns or on ideas for improved job work flow. Use feedback form or space below.

### 5. Department/Division, or their equivalent, Line Manager or Designee

Conditions are appropriate to start work: (Permit has been reviewed, work controls are in place and site is ready for job.)

Name:	Signature:	Life#:	Date:
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### 6. Worker provides feedback.

**Worker Feedback (use attached sheets as necessary)**

a) WCM/WCC: Are there any changes as a result of worker feedback? ☐ Yes ☐ No

Note: See Work Planning and Control for Experiments and Operations Subject Area section 2.6.

**7. Post Job Review/Closeout: Work Control Coordinator (authorizing dept.) checks quality of completed permit and ensures the work site is left in an acceptable condition. (WCC can delegate clean up of job site to work supervisor.)** The WCC ensures that the change process to update drawings, placards, postings, procedures, etc., is initiated, if necessary.

Name:	Signature:	Life#:	Date:
Comments:			

**FVTX & VTX Detectors Handling, Assembly & Installation Procedure****Introduction**

PHENIX has completed its experimental mission and is in the process of being removed and/or repurposed. This involves the removal of all detector subsystems and dispositioning them as appropriate for the future intended use. For the VTX and FVTX detectors this will involve removing and disposing of the cables and services, then uninstalling and relocating the east and west detector subsystems to the tracking lab in the BNL PHYSICS department where the detectors will be stored until the details of their repurposing are determined. The cooling circuits, chillers and associated equipment will be deactivated, and stored in a safe condition in place at the PHENIX 1008 complex.

The VTX is comprised of 4 concentric layers of detectors with the inner most 2 layers of the pixel type detector and the outer 2 layers of the strip-pixel variety. The detector signals are read out to circuit boards which amplify and convert the signals to light signals to be transferred to the PHENIX Data Acquisition system via optical fibers. These support electronics are mounted on large circular aluminum disks dubbed "big wheels". The detector and support electronics on the big wheels are cooled to predetermined temperatures for optimum operating conditions using a proprietary thermal transfer fluid, NOVEC 7200. The internal atmosphere of the detector subsystem is kept free of condensation/moisture by flowing gaseous nitrogen.

The FVTX is comprised of 4 disks of detectors longitudinally surrounding the beampipe and spaced north and south of the VTX subsystem. Similar to the VTX, the FVTX is physically divided into 2 semi-cylinders for ease of installation. The detector signals are read out to circuit boards which amplify and convert the signals to light signals to be transferred to the PHENIX Data Acquisition system via optical fibers. These support electronics are mounted on large circular aluminum disks dubbed "big wheels". The detector and support electronics on the big wheels are cooled to predetermined temperatures for optimum operating conditions using a proprietary thermal transfer fluid, NOVEC 7200. The internal atmosphere of the detector subsystem is kept free of condensation/moisture by flowing gaseous nitrogen. The NOVEC 7200 and N<sub>2</sub> distribution systems are shared with the VTX subsystem and having been designed and specified to accommodate both subsystems. No significant changes are proposed to the FVTX components during the 2014 shutdown, but there will be a series of tests and some minor troubleshooting of detector components which have exhibited less than optimal performance during run 14.

In this document, all facets of the removal and relocation of the VTX and FVTX subsystems.

**Removal of VTX/FVTX from CM Region****I. Removing Cabling and piping services (East & West Detectors)**

- a. Carefully label all Bias, LV, signal and monitoring cables with the VTX & FVTX numbering systems currently in use to minimize confusion when restoring these

services

- b. Similarly carefully label all piping connections for cooling and environmental control.
- c. Disconnect each cable, one at a time, coil the cables neatly and use cable ties to secure the cables in an area they will be safe until need again during re-installation of the VTX/FVTX.
- d. Turn off coolant flow and drain all coolant from the VTX & FVTX detectors and bigwheel electronics.
- e. Disconnect all piping, plug the VTX & FVTX fluid connections and cap the piping.
- f. Coil all piping and secure it where it will remain safe until need again during re-installation of the VTX/FVTX.
- g. Install the east and west support rail installation extensions. Install the soft beampipe shield and hard beampipe protectors around the central beampipe.

## II. East Detector Section Removal

- a. Separate the east VTX/FVTX detector half from the west half.
- b. Slide the east half detector away from the beampipe.
- c. Mount the VTX/FVTX installation fixture on the east VTX/FVTX detector half
- d. Rig the east VTX/FVT detector half installation fixture to the IR crane lift it off the rails and set it on the 12 ton cart to transport the assembly to the PHENIX AH, taking care not to jostle or otherwise disturb, distort, twist or shock the assembly.
- e. Rig the east VTX/FVTX detector half from the cart to the AH floor
- f. Check the entire assembly for activation prior to relocation from 1008 (BNL Health Physics)
- g. Transport the east half on a smooth riding vehicle with vibration isolation to prevent motion damage to the detector, to the assigned Chemistry lab for maintenance and upgrade.

## III. West Detector Section Removal

- a. Retract west VTX/FVTX to its "open" parked position

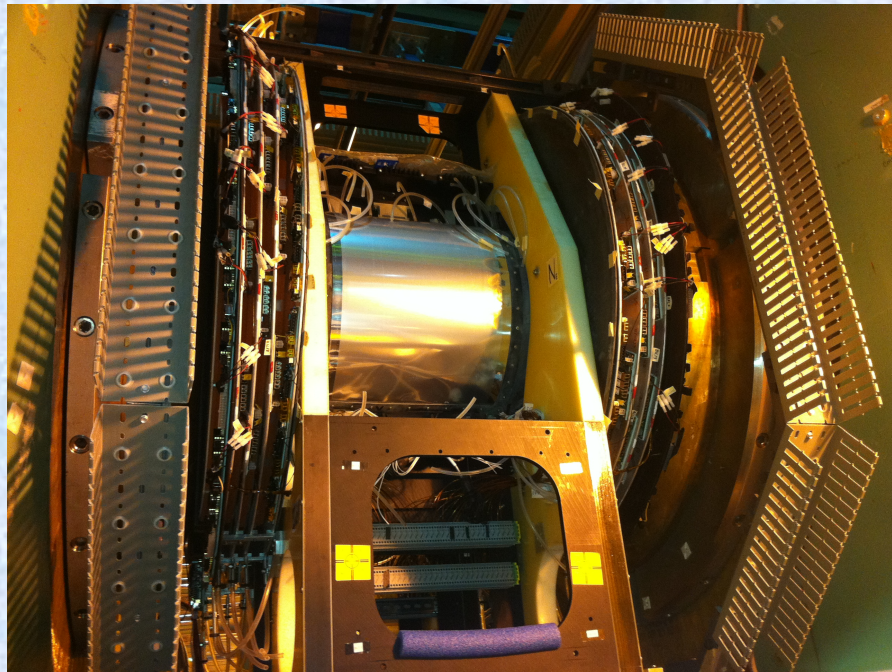
- b. Attach the transport fixture to the west detector half.
- c. Rig the transport fixture to the IR crane and lower the west half to the horizontal position.
- d. Disconnect the rigging from the crane.
- e. Slide the west VTX/FVTX detector half carefully under the Beampipe taking care to avoid any potential snags or pinch points, and taking exceptional care to avoid contact with the beampipe and/or the beampipe protectors (soft and hard).
- f. Attach rigging to the transport fixture.
- g. Lift the west detector half from the rails and carefully place the west half on the 12 ton cart to transport the assembly to the PHENIX AH, taking care not to jostle or otherwise disturb, distort, twist or shock the assembly.
- h. Rig the west VTX/FVTX detector half from the cart to the AH floor
- i. Check the entire assembly for activation prior to relocation from 1008 (BNL Health Physics)
- j.
- k. Transport the west half on a smooth riding vehicle with vibration isolation to prevent motion damage to the detector, to the assigned PHYSICS lab for maintenance and upgrade.

## **Work Permit Closeout**

When all work described in this work permit has been completed, the PHENIX work coordinator for this set of tasks shall collect feedback from all parties (PHENIX engineers and technicians and FVTX/VTX experts). This feedback shall include critical review of any problems encountered during removal, solutions to such problems, changes to work procedures described herein during the conduct of this work, suggestions for improvements in equipment procedures and techniques and any other information deemed useful and/or relevant by the PHENIX work control coordinator. Such information shall be appropriately disseminated to the various affected/interested parties and a copy of this information shall be attached to this work permit when it is closed out.

a.

# VTX/FVTX Removal



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Slide # 1



## VTX & FVTX Summary of Tasks

VTX/FVTX Disassembly - After Start of shutdown tasks are completed (EC out to AH), coolant and N<sub>2</sub> lines, LV, signal and HV cables and fibers will be carefully removed and coolant drained. East and west detector halves will then be de-mounted and transported to Chemistry bldg for maintenance and overhaul.

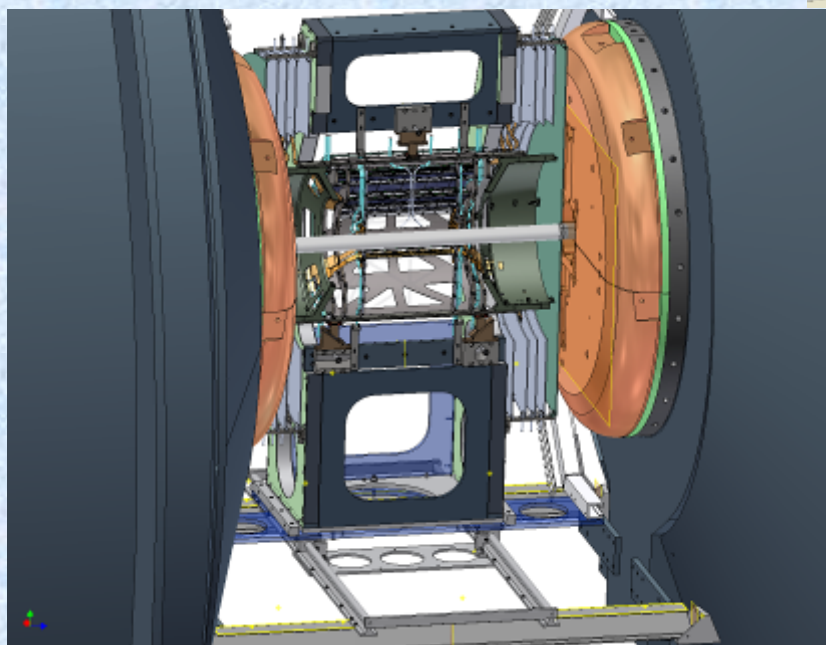
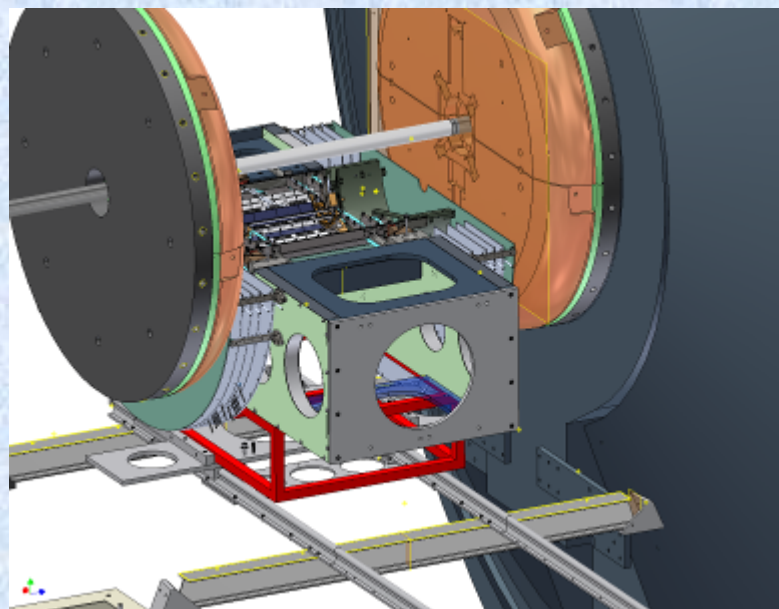
At PHYSICS lab - Put FVTX and VTX  $\frac{1}{2}$  detectors in a safe location with appropriate measures taken to assure components are safely and properly "mothballed" until repurposing efforts and final disposition are determined.





## VTX/FVTX RemovalPlan

(Same as last 5  
years)

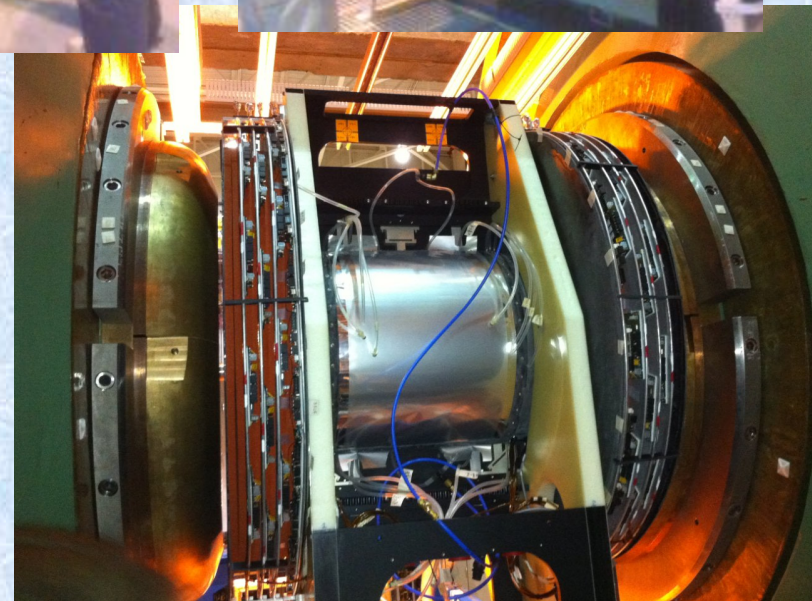


(Note: East side is lifted with slings to IR floor then hand carried to AH for activation check and relocation to PHYSICS. Then West is removed by installing carrying fixture, laying West detector over on its side - using crane through Bridge crate- then sliding west under BP, then lifted off and moved to AH etc as described for East  $\frac{1}{2}$  detector above.

7/1/2016



VTX Removal 2010,  
2011 & 2012, 2014 & 2015  
Removal will be essentially  
the same.



7/1/2016

**PH**  **ENIX** 2016 R&R

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